

## REMARKS

Claims 3, 7 and 8 have been canceled. Claims 1, 2, 4-6 and 9-15 and new Claims 16-19 remain active in the case. Reconsideration is respectfully requested.

The present invention relates to a method of producing a sintered silicon nitride filter.

### Claim Amendments

Claim 1 has been amended by limiting the same to a pore-forming agent of spherical polymer particles as disclosed in the paragraph of pages 5 and 6 of the text. Further, the heat-treatment of the particle mixture is defined as occurring in the presence of an atmosphere containing substantially only nitrogen to one that contains no oxygen as described in the first paragraph of page 12 of the text.

Claim 9 has been limited in the same way as Claim 1 with respect to the nitrogen atmosphere. In both Claims 1 and 9, mass % has been changed to the more usual weight %.

Claim 3 has been canceled because its subject matter has been incorporated into Claim 1.

Basis for new Claims 16 and 17 can be found on pages 5 and 4 respectively, while basis for new Claims 18 and 19 can be found on page 6. Accordingly, none of the newly presented claims raise an issue of new matter. Entry of the same is respectfully requested.

### Invention

As claimed in one embodiment of the invention, a sintered silicon nitride filter is produced by heat-treating, in a nitrogen atmosphere containing no oxygen, a green body comprising from 35 to 90 wt % of silicon nitride particles having an average particle diameter of from 1 to 30 $\mu$ m, from 5 to 60 wt % of a pore-forming agent of spherical organic polymer

particles ranging in size from 20 to 100  $\mu\text{m}$  and from 0.1 to 5 wt % of metal oxide solid particles, provided that the total amount of the silicon nitride particles, the pore-forming agent and the metal oxide particles is at least 90 wt %, to form a porous product.

In another aspect of the invention, a silicon nitride filter is prepared by heat-treating, in a nitrogen atmosphere containing no oxygen, a green body comprising from 45 to 85 wt % of silicon nitride particles having an average particle diameter of from 1 to 30 $\mu\text{m}$ , from 10 to 50 wt % of metal oxide hollow particles and from 0.1 to 5 wt % of metal oxide solid particles, provided that the total amount of the silicon nitride particles, the metal oxide hollow particles and the metal oxide solid particles is at least 90 wt %, to form a porous product.

#### Prior Art Rejection

Claims 1-15 stand rejected under 35 U.S.C. § 103 as being unpatentable over Niwa et al.

a1. This ground of rejection is respectfully traversed.

It is clear that the Niwa et al patent discloses a porous ceramic product that is stated as having thermal shock resistance. The product is prepared by heating a raw material ceramic powder as identified in column 4 that is selected from a group of materials including silicon nitride. In the thermal process of forming the porous ceramic product, hollow oxide particulate material is used as the means of introducing porosity into the ceramic product obtained. The sintered product obtained is used as a valve unit that has high durability.

Although the patent teaches a process in which a powdered ceramic starting material is heated under an atmosphere selected from a group as disclosed at column 7, lines 25-28 that includes nitrogen, which is the exclusive atmosphere of the present process in which silicon nitride is heated, nevertheless, the patent teaches other atmospheres that can be used which is in opposition to the requirements of the present claims. In the present process of

producing a porous silicon nitride product, heating can only occur under an atmosphere that contains substantially only nitrogen to one that contains no oxygen. Another **inert** gas may be present in the atmosphere, but very little oxygen (impurity levels) to no oxygen. Otherwise a product that is not satisfactory for use in the intended role of a filter is not produced. On the other hand, obviously, oxygen containing atmospheres are acceptable in the thermal treatment process of the patent as is clear from the disclosure in column 7.

Yet another important distinction between the present process as claimed and the patent is that, as set forth in amended Claim 1, the pore-forming substance is spherical organic polymer particles of a size ranging from 20 to 100  $\mu\text{m}$ . The particles are of the designated size in order to introduce the appropriate porosity into the product. On the other hand, the patent does not show a particulate, organic pore-forming material for the clear purpose of introducing pores into the ceramic product. Rather, the only disclosure of an organic material in the process of the patent is as a binder for the particulate mixture used as the starting material. As disclosed in column 7, lines 10-24, the organic material **must be** "burned off" or evaporated from the ceramic prior to any sintering of the ceramic. There is no pore forming function taught for the organic material. In fact, to the contrary, there is a clear teaching in the patent which leads the skilled artisan away from the use of organic binder material in the preparation of the porous product of the patent in the experiment of columns 8 and 9. In the Comparative Examples 1 to 3, epoxy resin, acrylic resin and phenolic resin were used as binders. The results shown in Table 1 in column 10 of the patent show that porous ceramic products of these three examples were obtained, all of which exhibited inferior thermal shock resistance, rate of  $\Delta T$  and sliding durability properties in comparison to Examples 1 and 2 of the patent. Accordingly, with respect to Claim 1 as now claimed, Niwa et al does not suggest the method of Claim 1 of the present case.

As to Claim 9, the previous comment about the failure of the patent to exclusively suggest a sintering atmosphere containing substantially only nitrogen to one that excludes oxygen also applies to this claim. Further, although in Claim 9 hollow metal oxide particles are employed to prepare the porous ceramic nitride product of the invention, the hollow particles are **not** used exclusively to prepare the product, but rather are used in combination with solid metal oxide particles to prepare the product of appropriate porosity. On the other hand, the **only** material taught by the patent in the intended role as a porosity inducer is hollow metal oxide particles. Accordingly, the Niwa et al patent is believed not to suggest the invention as claimed and withdrawal of the rejection is respectfully requested.

It is submitted that this application is now in condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

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**IN THE CLAIMS**

Please cancel Claims 2, 7 and 8 and amend Claims 1 and 9 to read as follows:

--1. (Twice Amended) A method for producing a silicon nitride filter, which comprises:

heat-treating in an atmosphere containing substantially only nitrogen to one that contains no oxygen a green body comprising:

from 35 to 90 [mass%] wt % of silicon nitride particles having an average particle diameter of from 1 to 30 $\mu$ m,

from 5 to 60 [mass%] wt % of a pore-forming agent of spherical organic polymer particles ranging in size from 20 to 100  $\mu$ m and

from 0.1 to 5 [mass%] wt % of metal oxide solid particles,

provided that the total amount of the silicon nitride particles, the pore-forming agent and the metal oxide particles is at least 90 [mass%] wt %, to form a porous product.

9. (Twice Amended) A method for producing a silicon nitride filter, which comprises:

heat-treating in an atmosphere containing substantially only nitrogen to one that contains no oxygen a green body comprising:

from 45 to 85 [mass%] wt % of silicon nitride particles having an average particle diameter of from 1 to 30 $\mu$ m,

from 10 to 50 [mass%] wt % of metal oxide hollow particles and  
from 0.1 to 5 [mass%] wt % of metal oxide solid particles,  
provided that the total amount of the silicon nitride particles, the metal oxide hollow  
particles and the metal oxide solid particles is at least 90 [mass%] wt %, to form a porous  
product.--

Please add the following new claims.

Claims 16-19. (Newly Added)